'Chaotic Narrative: Complexity, Causality, Time and Autopoiesis in David Mitchell's *Ghostwritten*'
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'simplicity is not the hallmark of the fundamental'
(Prigogine and Stengers 1985: 216)

It is impossible to read or write about David Mitchell's first novel *Ghostwritten* (1999) without remarking upon, and attempting to understand, its structure. *Ghostwritten* consists of nine interconnected short stories, each narrated by a different character and set in a different geographical location, with an epilogue which returns the reader to the pre-story of the opening. In an interview with Catherine McWeeney, Mitchell explains that,

> The first three stories started life as unrelated short stories that I wrote on location. Then when I realized there was narrative potential waiting to be tapped by linking the stories, it made sense to keep the locations on the move. The far-flung locations test-drive this interconnected novel about interconnection more strenuously. (Mitchell with McWeeney)

There is no question, then, that in both its structure and content this is a novel about interconnection. Reviews of the novel have not failed to observe this fact, but none has discussed in an adequate way what the text is actually saying about interconnection and to analyse in any detail how it is saying it; none has explored what narrative potential is actually achieved by linking the stories, not least, the effect such a novelistic structure has on the act and experience of reading and on our contemporary understanding of the nature of textuality.[i] It is precisely this lack in current commentary on the novel that this paper aims to fill by arguing that the ideas about interconnection and causality found in both the novel's structure and content can best be understood with reference to the science of complexity, an interconnection reinforced by the title of the German translation of *Ghostwritten* which translates back into English as *Chaos*. Analysing the novel in these terms provides a language with

which to talk adequately about the structure and content of the novel, and provides some intriguing answers to the broader issues of time, causality, reading and textuality which it raises.

I. Complexity

Many reviewers of *Ghostwritten* have sought to shed light on its structure by placing it within a literary and filmic tradition of similarly structured narratives.[ii] In the same methodological vein, I would suggest that a productive comparison can be made between Mitchell and the modernist writer H.D. Whilst less ambitious in its scope, H.D.'s novel *Palimpsest* (1928) resembles *Ghostwritten* structurally: it consists of three interconnected stories about three different women set in three different historical periods – 'Hipparchia: War Rome (*circa* 75 B.C.), 'Murex: War and Postwar London (*circa* A.D. 1916-1926)' and 'Secret Name: Excavator's Egypt (*circa* A.D. 1925). As A. Kingsley Weatherhead notes in 'Style in H.D.'s Novels' (1969), the stories are connected at the microscopic and the macroscopic levels: 'we are presumably intended to remark the superimpositions – at one end of the scale, of images, and, at the other, of large situations' (543). At the former, he observes 'minor details and motifs' which, 'mutually illuminating or justifying each other and linking together the parts of the whole', serve to create the impression of each part, and the whole novel, as 'a tissue of sensations lightly matching one another, woven together by mysterious thin threads of plot and theme' (541). At the macroscopic level, Weatherhead notes substantial plot patterning between the stories which later critics have gone on to comment upon in detail.[iii] Although each of *Ghostwritten*'s stories does not follow the same plot, the text does contain similar levels of interconnection, from the microscopic repetition of motifs and phrases to the macroscopic repetition and intersection of characters and themes.[iv]

In addition to the structural similarities between these two works, there is a further and more important connection between H.D.'s writing and *Ghostwritten*. In the structure and content of both can be found an insight into the world that, as Adalaide Morris observes in 'Science and the Mythopoeic Mind: The Case of H.D.' (1991), 'parallel[s] the revolutionary advances of twentieth-century science' (195). In this essay, Morris demonstrates how, 'like chaos theory, H.D.'s mythopoeic writings

pull seemingly random or disorganized phenomena into dynamic relation by discovering patterns which repeat across scales or recur one inside the next' (Morris 1991: 211). Morris compares the patterns produced in H.D.'s writing with those seen in mathematical representations of strange attractors. Phase space diagrams of strange attractors produce 'a pattern that is neither a fixed point nor a limit cycle but an orbit that always stays within certain bounds without ever crossing over or repeating itself' (Morris 1991: 213). In the same way, Morris argues that 'the patterns in H.D.'s poem do not replicate each other exactly, but neither are they a jumble. They have a disorderly order that emerges slowly but surely' (214). In *Chaos: Making a New Science* (1987), James Gleick explains that

> the eerie effect of the strange attractor can be appreciated…when the shape emerges in time, point by point. It appears like a ghost out of the mist. New points scatter so randomly across the screen that is seems incredible that any structure is there, let alone a structure so intricate and fine. (150)

The appearance of the interconnections between the stories in *Ghostwritten* as the reader reads and rereads the text has precisely the same effect, characters, scenes, phrases and ideas reappearing on different scales, repeating but never exactly replicating each other.

Similar to *Palimpsest*, *Ghostwritten*'s nine stories indicate their location in their title: 'Okinawa', 'Tokyo', 'Hong Kong', 'Holy Mountain', 'Mongolia', 'Petersburg', London', 'Clear Island' and 'Night Train'; unlike *Palimpsest*, they do not indicate the main character from whose perspective the narrative is told. These are, in order: Quasar, a doomsday cult terrorist on the run after carrying out a gas attack in Tokyo; Saturo, an endearing young musician and record shop boy who falls in love with a beautiful Hong Kong school-girl; Neal Brose, a Nick Leeson type lawyer whose life disintegrates due to untreated diabetes and his dodgy business dealings; the Tea Shack Lady who watches the history of modern China unfold from her mountain home; a disembodied spirit, or 'noncorpum', who transmigrates from host to host searching for the mystery of its origin; Margarita Latunsky, a pitifully self-deluded former courtesan embroiled in a Petersburg art theft ring; the lovable rogue Marco, professional ghost writer and musician, who maps London by 'trigonometrical shag points' (Mitchell 1999: 290);[v] Dr Mo Muntervary, a scientist

with a conscience who also goes on the run after her quantum cognition technology is put to military uses; and the loquacious Bat Segundo, late night radio host and interlocutor of the Zookeeper, the advanced artificial intelligence Mo invents which, in homage to Isaac Asimov's robots, is governed by moral laws designed to control its own behaviour. Each of these characters inhabits an entertaining and skilfully constructed story in its own right, but each of these stories also contains complex interconnections with the others in the novel. Later in this paper I will analyse in more detail the way in which the stories and the novel might be understood to be functioning in relation to each other, via Humberto Maturana and Francisco Varela's theory of autopoietic systems, but first I want to enumerate in detail at least some of the microscopic and macroscopic connections between the stories, those that serve to render its appearance as finely ordered and patterned as a chaotic system.[vi]

Perhaps one of the most easily noticeable categories of interconnection in *Ghostwritten* is that of the reappearance of characters across stories, sometimes in lead roles, sometimes as merely extras passing through the main narrative. As he so often does in interviews, Mitchell uses a scientific metaphor to describe his work, in this instance talking about the way the characters 'collide in' (Mitchell with McWeeney) various cities, as if they are molecules in a gas. The first character reappearance occurs on a very small scale in 'Tokyo' in which Mr Ikeda, the school teacher Quasar remembers from his childhood, also turns out to have been Saturo and his friend Koji's teacher as well (5, 31, 45). Although this indicates that Quasar and Saturo may well have collided in their youth, the first character collision within the text occurs in 'Hong Kong' when Neal Brose actually shares a table with Saturo and his love Tomoyo. Neal bears witness for the reader to the fact that the couple are going to build a life together in 'Hong Kong':

> This kid and his girl came in. He ordered a burger and cola. She had a vanilla shake. He picked up the tray, looked around for a seat that wasn't there, and caught me watching him…He had a saxophone case, and a small backpack with airline tags still attached…They just held hands over the table. Of course, I didn't understand a word, but I guessed they were discussing possibilities. They were so happy. (77-8)

This provides the reader with a satisfying post-story update on Saturo and Tomoyo's romantic relationship, since 'Tokyo' has ended on something of a cliff-hanger, with Saturo deciding to fly to Hong Kong. These human molecular collisions continue throughout the rest of the novel. At the end of 'Holy Mountain', the maid with whom Neal was sleeping arrives to visit the Tea Shack Lady, her great-grandmother, having done well for herself since Neal's death: 'My employer died. A foreigner, a lawyer with a big company, he was extremely wealthy. He was very generous to me in his will' (151). Mo, the lead character in 'Clear Island', appears in the background in an earlier story, 'Mongolia': 'Also in the Swede's compartment was a middle-aged Irish woman who either gazed out of the window or wrote numbers in a black notebook' (155). The terrifying KGB agent Suhbataar reappears in 'Petersburg' from 'Mongolia' to play an equally fatal role in that story's plot. More curiously, Margarita finds herself in Quasar's tunnel dream (19) and watches as he runs past her: 'Two people ran past, both slitty-eyed, a man and a woman' (239). Katy Forbes, Neal's ex-wife, merely an answering phone message and a memory in 'Hong Kong', plays a more central corporeal role at the beginning of 'London' and the gay English art forger who meets his gruesome death at Margarita's hands in 'Petersburg' reappears in name in 'London' as news of his death reaches his friends, Alfred and Roy, for whom Marco works. The investigations of a minor character, Huw Llewellyn, prompt Neal's breakdown in 'Hong Kong' (99-101); it is not until 'Clear Island' that we discover Mo has been staying with Huw in his flat there, since he is a friend of her husband John (322, 338). On her travels, Mo has also unknowingly met both Tomoyo from 'Tokyo' (338), Sherry from 'Mongolia' (369) and has witnessed Neal's death (364). Another pleasing insight into the development of Saturo's life is found in 'Night Train' where the reader discovers that he has guested as a saxophonist on Bat's show (385). Dwight Silverwind, who appears only in name in 'London' as the Life Coach of the lady Marco meets in Iannos' snack bar (298) meets his untimely death at the hands of the Zookeeper in 'Night Train' since his prediction that 'an artificial intelligence, created by the military to invade and take over the enemy's computer and weapons systems, has broken loose and is controlling the whole planet with a chilling agenda of its own' (399-401) unwittingly breaks the Zookeeper's second law, that of invisibility (421). Quasar from 'Okinawa' also reappears in 'Night Train' as a phone-in guest of the show with the ominous news that he has continued His Serendipity's cult (415).

Finally, a character reiteration that is not quite a repetition occurs when a disembodied spirit that is not the one narrating 'Mongolia' – since he has taken corporeal form again – calls into Bat's show. His name is Arupadhatu which is the name, the reader recalls, of the 'being of pure consciousness' who Quasar describes as having 'transmigrated into His Serendipity, and revealed the secrets of freeing the mind from its physical shackles. This had been the beginning of His Serendipity's path up the holy mountain' (30). In a typical example of that way in which the interconnections between the stories become more complex and involved, as well as reverberating out across the text, the reader learns that this disembodied spirit has spent some time in Mo (421) and his appearance here casts doubt on the reader's interpretation of Quasar's story. On first reading 'Okinawa', it seems obvious that Quasar is deluded and that His Serendipity is a spiritual fraud. However, the appearance of this spirit in the last story of the novel and his verification of at least part of Quasar's story starts to complicate such an easy interpretation. This method of casting the reality of a previous story into doubt is repeated at length in Mitchell's second novel *Cloud Atlas* (2004) with which *Ghostwritten* also shares a number of other interconnections.[vii] Not least of these is the appearance of Luisa Rey, one of the lead characters in one of *Cloud Atlas*'s stories, in 'Night Train', together with the revelation that she is the bestselling author of *The Hermitage*, 'the greatest true-crime psychological exposé written since Capote's *In Cold Blood*' (385). *The Hermitage* is the name of the art gallery in which Margarita works in 'Petersburg' – has this story, then, been a "true" account of those events or is it an extract from Luisa's book?

In addition to the repetition, in more and less prominent capacities, of characters across the novel, the reader also finds the repetition of phrases, some exactly the same, and some with a slight variation, indicating a shared experience of the world across characters: Quasar's observation that 'High streets are becoming the same all over the world, I suppose' (12) is repeated by Margarita (217); Saturo's boss Takeshi believes that one should 'Only shag women who have more to lose than you do' (36), a sentiment shared but phrased slightly differently by Bat, 'never have affairs with women who have less to lose than you do' (388); Neal imagines that he appears as a 'foreign devil' (84) to a native of Lantau Island, which is exactly the phrase the Tea Shack Lady uses (134). Another thread binding the stories together is geographical references to the location of other stories, either in a literal or a metaphoric capacity: the Holy Mountain appears in 'Okinawa' in His Serendipity's

71st Sacred Revelation: '*The fury of the damned is as impotent as a rat gnawing a holy mountain'* (9); in 'Tokyo', Koji's sister goes 'on a school trip to Okinawa' (40). Mongolia, in particular, seems to attract a lot of references: Neal forces himself to 'finish reading the article, though it could have been written in Mongolian' (83); the Tea Shack Lady refers to far-away places beyond the Valley, 'Places called Manchuria, Mongolia, and further' (119); a minor character, Brain, in 'Holy Mountain' is sent to 'an Inner Mongolian prison' (141); and Marco dreams of running away to some place far away, 'Mongolia would suit me fine' (292). Caspar, one of the disembodied spirit's hosts, has worked in Okinawa and other people's realities become another person's imagery, such as when Bat complains that his studio is as stuffy as 'a Kowloon laundromat' (394).

There are many more interconnections between the stories, some of which will be referred to in the following sections. The details above give some impression, though, of the mesmerising interweaving of the stories that constitute *Ghostwritten*. As such, this novel performatively proves David Porush's argument in 'Prigogine, Chaos, and Contemporary Science Fiction' (1991) that literature has epistemological value in accurately representing the complexity of the contemporary world. With reference to the work of Ilya Prigogine, Porush explains how Western science's tendency 'to proceed from large assumptions to finite conclusions which subsequently are granted the force of law' induces a simplicity which 'stands in direct contrast with how reality proceeds in the macrocosmic world' (370). Tracing the history of development in physics from the dominance of the Newtonian world-view to the rise of the science of complexity, Porush explains how:

> Newton's universe is a simple and tidy place, a comforting but imaginary realm which idealizes relationships between matter and energy and makes the laws of nature seem tractable and predictable.
>
> In contrast, most phenomena in the world around us, our senses tell us, are extremely complicated, seething with multiplying forms and interactions, edges, microstructures within macrostructures. Reality is bumpy, grainy, noisy and unpredictable. Furthermore, we have trouble describing this reality in the strictly simple and logical way scientific discourse demands. (370)

Porush claims that literature, rather than science, has traditionally provided a more appropriate discourse to represent such a reality, but that Prigogine's theories provide a reconciliation of the two-cultures problem since they provide science with a language with which to respond to this complexity of the macroscopic world.

In *Ghostwritten*, the Zookeeper comes up against precisely the problem Porush outlines as facing modern science. The Zookeeper's designers have provided him with a set of moral laws with which to govern his behaviour and he has at first believed, as did/do Newtonian physicists, in the power of those laws: 'When I was appointed zookeeper, I believed adherence to the four laws would discern the origins of order' (425-6). However, events, particularly those which throw the laws into conflict with each other, have made the Zookeeper realise that this is not the case and that the order he thought the laws would produce is actually chaos: 'The third and fourth law are in chaos, Bat. I'm sorry' (420). In the same way, Porush explains that it is reassuring to 'reduce everything to a few simple universal rules' (1991: 37) and that this in fact is what we habitually do both in our sense perceptions and in our mental interpretations of the world, 'as our eyes habitually abstract a simple pure line from the chaotic tangle of color and edges and motion around us or as our mind abstracts a pattern of events, a plot, out of a welter of events' (1991: 37). However, he argues that this compulsion to simplicity is also an idealisation and that whilst

> we couldn't function without the ability to abstract, to formulate heuristics, to leap to conclusions, to induce hypotheses and predictions, to devise schemas, to tell ourselves unifying stories…to design an entire epistemology on this habit of simplifying and unifying – to insist that nature must be fundamentally simple – brings us into conflict with the obvious nature of things around us. (Porush 1991: 370)

Ghostwritten's impressive achievement is both to succumb to and satisfy the need to tell stories, to devise plots (within the self-contained narratives of the individual stories) whilst at the same time (by presenting those stories alongside each other and creating a dense network of connections between them) representing that 'seething complexity' (Porush 1991: 371) of the macroscopic world from which we abstract those stories and plots. This is the narrative potential waiting to be tapped by linking the stories; this is what makes *Ghostwritten*, in all the senses of that word, a chaotic

narrative, the form of narrative necessary to bear witness to the nature of lived experience in the twenty-first century.

The connection between *Ghostwritten* and chaos theory, made via H.D.'s writing, reveals the way in which the structure of *Ghostwritten* can be usefully understood in the context of the science of complexity's shift in understanding from a simple, linear, deterministic ordered world to a complex, non-linear unpredictable chaotic order. These insights are not limited merely to understanding the interconnections between the novel's stories, however. The science of complexity has profound implications for understanding many other aspects of *Ghostwritten*, not least how the text, and the experience of reading it, causes us to understand causality and time.

II. Causality

Another of the repeated but not replicated patterns that constitute *Ghostwritten*'s complex textuality is a thematic concern with causality and its related themes of cause and effect, chance and fate. In the first story, 'Okinawa', His Serendipity suggests to Quasar that the reason he joined the sect was not luck but love: 'we both know that it was not luck which brought you here. Love brought you to us' (10). The issue of why often intelligent human beings would want to abdicate their wills to His Serendipity is addressed later in the story by a small group of Kumejima islanders. The teacher of the group suggests that 'maybe there are many answers' (23) ranging from an attraction to self-abasement, to loneliness and fear, to a hunger for importance, to revenge, to the desire for magic. Quasar counters her speculations with the suggestion that 'maybe you're reading too much into it. Maybe they just did it because they loved him' (23-4). Love is again offered as the prime cause in 'Tokyo', although this time it is romantic and erotic rather than spiritual devotion. Although other more comic causes of relationships are suggested – Saturo and his best friend Koji meet as a result of a combination of 'a winded games teacher and the foulest toilets in the Tokyo educational system' (46) – Mr Fujimoto's suggestion for why 'things *happen* at all? What is it that stops the world simply…seizing up?' (61) is love: 'Might the answer be "love"?' (61). In the end, Saturo decides to change his life based on his love for Tomoyo: 'If not love, then what?' (63). In 'Hong Kong', close to his death, Neal wonders 'What led me here?' (105). The text does not provide an

answer but the reader wonders if it is precisely a lack of love that leads to Neal's downfall, the breakdown of his marriage caused by their inability to produce a baby to love, as well as a lack of love of himself and of life:

> Or is it not a question of cause and effect, but a question of wholeness?
>
> I'm this person, I'm this person, I'm that person, I'm that person too.
>
> No wonder it's all such a fucking mess. I divided up my possible futures, put them into separate accounts, and now they're all spent.
>
> Big thoughts for a bent little lawyer. (108)

The lowly Tea Shack Lady also has such big thoughts in relation to the grander scope of historical events. 'Why,' she asks, 'are men forever marching up the path to destroy my Tea Shack? Why do events have this life of their own?' (138). The noncorpum of 'Mongolia''s quest is to discover not only the reason why it is a disembodied spirit, but also why it is the kind of character that it is: 'Why am I the way I am? I have no genetic blueprint. I have had no parents to teach me right from wrong. I have had no teachers. I had no nurture, and I possess no nature. But I am discreet and conscientious, a non-human humanist' (169). The question of causality is one so important to human culture that it is the basis of all the myths that are told in 'Mongolia': the myth that the noncorpum uses to track down his identity regarding 'the three who think about the fate of the world' (157) is about why the crane, locust and bat behave the way they do; the same pattern is found in the myth that explains the appearance and character of the camel, the deer and the horse (186-7); and the story of the red plague explains self-referentially why the Mongols tell each other tales (175-6).

In "Petersburg', Margarita Latunsky has very clear ideas about why things happen – 'I'm going to tell you a secret. Everything is about wanting. Everything. Things happen because of people wanting. Watch closely, and you'll see what I mean' (211) – and it is indeed 'wanting' – or, less euphemistically, desire and greed – that motivate the characters in 'Petersburg'. Interestingly, though, for Margarita love is exempt from the question of causality – 'We're talking about love. There is no "why". That's the point' (229) – which would make sense if love is indeed the Prime Cause itself in no need of explanation, as suggested in the earlier stories. Tatyana is less romantically inclined, however, and thinks that even love can be explained

according to Margarita's own causal criteria: 'There is always a "why", because there is always something that the beloved wants…Love is a big knot of *whys*' (230). The novel's reflections on causality with specific reference to the battle between chance and fate peak in 'London', a story which in part, not inconsequentially, takes place in a casino and features a band named 'The Music of Chance'. Worrying about his regular partner Poppy's missed period first prompts Marco to reflect in a characteristic way on the question of why things happen:

> And when, in twenty years time, a professor of philosophy asks him [their potential child] 'Why do you exist?' he can toy with his nose-ring and answer, 'rugged lust and ruptured rubber'. Weird. If I'd bought the pack behind on the condom shelf he wouldn't be/won't be sitting there. Unmix that conditional and smoke it. (271)

The purchase of that particular pack of condoms is, in Prigogine's language, one of the fluctuations in 'London' that perturbs Marco's current existence and leads to a bifurcation point in his life. As Alvin Toffler explains in the introduction to Prigogine and Stengers' *Order Out of Chaos* (1984):

> In Prigoginian terms, all systems contain subsystems, which are continually "fluctuating." At times, a single fluctuation or a combination of them may become so powerful, as a result of positive feedback, that it shatters the preexisting organization. At this revolutionary moment – the authors call it a "singular moment" or a "bifurcation point" – it is inherently impossible to determine in advance which direction change will take: whether the system will disintegrate into "chaos" or leap to a new, more differentiated, higher level of "order" or organization, which they call a "dissipative structure." (Prigogine and Stengers 1985: xv)

This moment occurs for Marco at the end of the story, when, hiding in a casino's cleaning cupboard, there occurs what in the literary theory of short stories would be described as the epiphanic moment in the text:

> Causes and effects politely stand up and identify themselves. At such times I understand the futility of worrying. I shut up and I see the bumbling goodness behind the bitching and insecurity. Tying my future to Poppy's and India's – if they would have me – would be the greatest, never-ending, Richter-busting plunge I could ever take. (316)

This realisation shatters the pre-existing organisation of Marco's life – casual employment, casual sex, spiralling debt – and represents a leap to a new higher level of order: marriage to Poppy, and all the changes in his behaviour and lifestyle that that will entail.

What is so interesting about bifurcation points, in the context of the issue of causality, is that they demonstrate the simultaneous and interconnected operation of both determinism and chance. As Toffler explains:

> when fluctuations force an existing system into a far-from-equilibrium condition and threaten its structure, it approaches a critical moment or bifurcation point. At this point…it is inherently impossible to determine in advance the next state of the system. Chance nudges what remains of the system down a new path of development. And once that path is chosen (from among many), determinism takes over again until the next bifurcation point is reached.
>
> Here, in short, we see chance and necessity not as irreconcilable opposites, but each playing its role as partner in destiny. (Prigogine and Stengers: xxiii)

Or, in Marco's more succinct expression: 'my fate was in the hands of chance' (316). In 'London', Marco develops his own theory of the interconnectedness of fate and chance which posits their difference as a matter of the perspective of the observer:

> I watched the All-Blacks score three times against England, and formulated the Marco Chance versus Fate Videoed Sports Match Analogy. It goes like this: when the players are out there the game is a sealed arena of interbombarding chance. But when the game is on video then every tiniest action already exists. The past, present and future exist at the same time: all the tape is there, in your hand. There can be no chance, for every human decision and random fall of the ball is already fated. Therefore, does chance or fate control our lives? Well, the answer is a

> relative as time. If you're in your life, chance. Viewed from the outside, like a book you're reading, it's fate all the way. (292)

Whilst Marco's theory does not replicate the precise nature of the interconnection of fate and chance as elaborated by Prigogine and Stengers, it does at least share the same sentiment. Where Marco's life resembles the Prigogine model of dissipative structures more exactly is in the imagery of the moment of transition. Prigogine and Stengers explain that 'whenever we reach a bifurcation point, deterministic description breaks down. The type of fluctuation present in the system will lead to the choice of the branch it will follow. Crossing a bifurcation is a stochastic process, such as the tossing of a coin' (177). This is the same coin that Marco tosses into the wheel of fortune telephone to take his chance with Poppy: 'The telephone was one of the old dial types. All these circles and wheels spinning separately together. I rolled my coin in' (317).

Marco's story demonstrates the way in which the two seemingly opposed explanations of causality presented in *Ghostwritten* – chance and fate versus love – are actually also interconnected: love is perhaps the most powerful fluctuation capable of prompting self-reorganisation to a higher level of complexity in a system. Love and science thus achieve a synthesis that becomes romanticised in 'Clear Island' – a characteristic trait of this story – by Mo, whose scientific understanding of causality incorporates love. At the end of her story, although she is forced to embrace the life in the United States from which she is running, the presence of her beloved husband John by her side and the promise of seeing her son at Christmas causes her own epiphanic realisation that love acts as a unifying cosmic force: 'Finally, I understand how the electrons, protons, neutrons, photons, neutrinos, positrons, muons, pions and quarks that make up the universe, and the forces that hold them together, are one' (380).

Discussing the novel at Tokyo University in 2005, Mitchell identifies the main theme in *Ghostwritten* as causality and he describes the repetition but not replication of discussions of this theme which I have just traced in some detail:

> You have a main theme in *Ghostwritten*. It is causality. You make each of the different voices look at that theme from a different view. Even though the stories are very different, the reader soon picks up that it's the same mountain peak that's

> being climbed up different paths, on different faces, each of which increases your knowledge of the same theme mountain.

In this interview, Mitchell also suggests, however, 'another way' in which the theme of causality is addressed in the novel:

> have them [the stories] bang through the walls of each other's worlds occasionally. It happens in *Ghostwritten* by actions. There's one action in each of the stories that makes the succeeding story possible. That links the stories. It gives the reader the sense of there being a macro plot between the covers, over and above the micro plot between the beginnings and endings of the chapters.

Mitchell's language of simple linear cause and effect here, as well as his reference to macro and micro, recalls the way in which the issue of linear causality has precisely been called into question by the science of complexity and its reinterpretation of classical physics' understanding of the relationship between the microscopic and macroscopic realms. Just one of the revolutionary changes that Prigogine's thought heralded was the imperative that science must start from an analysis of the complex macroscopic level, not the idealised microscopic simplicity of two bodies interacting in pure Euclidean space. As Mo notes, 'nowhere does the microscopic world stop and the macroscopic world begin' (373). Whereas in the past fluctuations have played 'a minor role in macroscopic physics, appearing only as small corrections that may be neglected if the system is sufficiently large' in far-from-equilibrium systems close to bifurcations such fluctuations 'play a critical role because there the fluctuation drives the average. This is the very meaning of the concept of *order through fluctuations*' (Prigogine 1980: 132). For living organisms, such as human beings – which are just such far-from-equilibrium objects – the smallest event or action can have enormous consequences. Again, as Mo observes, 'phenomena are interconnected regardless of distance, in a holistic ocean more voodoo than Newton. The future is reset by the tilt of a pair of polarised sunglasses' (375). This kind of causality is not the deterministic linear cause and effect of Newtonian physics but a more complex probabilistic and unpredictable causality which Prigogine and Stengers refer to as statistical causality:

> Classical science aimed at a "transparent" view of the physical universe. In each case you would be able to identify a cause and an effect. Whenever stochastic description becomes necessary, this is no longer so. We can no longer speak of causality in each individual experiment; we can only speak about statistical causality. (311)[viii]

In the light of this revised understanding of causality, it is necessary to nuance Mitchell's observation: there is not one action in each of the stories that makes the succeeding story possible in the sense that there is a direct relation of predictable cause and effect; rather, it can be seen that small actions in one story have unpredictable and often larger-scale reverberations in succeeding stories. Thus, causality between the stories resembles that described in chaos theory where 'a small fluctuation may start an entirely new evolution that will drastically change the whole behaviour of the macroscopic system' (Prigogine and Stengers 1985: 14). These fluctuations do not make the succeeding stories possible as a system – in the sense that most of the "succeeding" stories pre-exist the temporal moment of the fluctuation in the preceding story – but they start an entirely new development within the behaviour of that preexisting system. In literary terms, they alter the plot development of that story.[ix]

To give some examples, then, 'Okinawa' is linked with 'Tokyo' in that when Quasar makes his last resort telephone call to the Fellowship's Secret Service (27) he actually dials Saturo's record shop in Tokyo. The compulsion to reopen the shop after he has locked up in order to answer this call means that Saturo is there to receive Tomoyo's second visit: 'I've thought about it many times since: if that phone hadn't rung at that moment, and if I hadn't taken the decision to go back and answer it, then everything that happened afterwards wouldn't have happened' (54). In the hunt for more of such obvious causal links between stories, it is easy to mistake the fluctuations that actually cause re-organisations. In 'Hong Kong', for instance, it is tempting to think that it is Neal's encounter with Saturo and Tomoyo that precipitates his breakdown, but it is actually his ensuing meeting with Huw Llewellyn. 'Holy Mountain' is linked to 'Hong Kong', as observed above, since Neal's maid is the great-granddaughter of the Tea Shack Lady – in this sense, her rape by the Warlord's son has reverberations in Neal's life, making one aspect of his story, his relationship with the maid, possible. 'Holy Mountain' is also linked with 'Mongolia' since the

noncorpum lives in the Tea Shack Lady for some time; when one of her guests tells her child the story about 'three animals who think about the fate of the world' (143) this returns the noncorpum to the quest of which we get the full story in 'Mongolia'. 'Hong Kong' has significant reverberations in 'Petersburg', Neal's death arousing Mr Gregorski's suspicions about Rudi and his gang when the latter, '"lost" a wall of money he was laundering through a reputable Hong Kong law firm, and the only excuse he could come up with what that his contact there suddenly dropped dead of diabetes!' (259). The art theft scam has been ongoing for some time before Neal's death but this event heralds a significant change in events with the arrival of Suhbattar and, eventually, the deaths of Rudi and Jerome. In a more complicated chain of reverberations, Neal's death prompts somebody to return the Queen Anne chair to his ex-wife Katy Forbes in London which arrives when she is having breakfast with Marco after a one-night stand. As a result, she asks Marco to leave, which means he is in the right place at the right time to rescue Mo from being run over by a taxi: 'Weird. If that chair hadn't arrived when it did, and Katy hadn't flipped out and asked me to leave, then I wouldn't have been at that precise spot to stop that woman being flattened' (275). This, as well as his subsequent lies to the Texan regarding to which airport Mo has travelled, enables Mo to survive long enough in order to develop the AI, the Zookeeper, which is eventually to end the world in the post-story of 'Night Train'. In these complex webs of causality, *Ghostwritten* demonstrates that, as in life, the answer to Father Wally's bemused appeal for clarity – 'How did all of this come about?' (375) – is never as simple as Newtonian physics would have it.

At the same time, it is important to note in closing this discussion of chance, that *Ghostwritten* combines these stochastic causal relations between the stories with a more classical deterministic plot, thereby offering its own take on the nature of the interwoven relationship between fate and chance. Whilst the events between the stories can be accurately described in terms of the science of complexity's theory of statistical causality, the presence of the reiterative motifs of the zoo, the bat, the comet and the end of the world throughout the nine stories plot a sinister predetermined fate for mankind. Although the novel ends with an epilogue entitled 'Underground' which returns the reader to the moment of the gas attack only retrospectively narrated in 'Okinawa', this chapter does not represent the "end" of the story, only a return to its beginning. (I will discuss this circularity in detail in the following sections.) The story of the novel actually ends, the reader can only assume, with the annihilation of

mankind, a course of action Bat unknowingly recommends to the Zookeeper who is at the end of his moral tether given humanity's tendency to (self)destruction:

> 'I wish to know peace of mind, Bat.'
>
> 'Then ditch this "ethical variable" jargon. Drop whatever is getting in the way.'
>
> 'The fourth law. The visitors I safeguard are wrecking my zoo.'
>
> 'If locking out your "visitors" brings you peace of mind, then out with 'em! How soon can you do it?
>
> 'The opportunity presents itself in thirteen days, Bat.' (428)

This opportunity is the comet which we have been led to believe is shortly to pass close to earth. The reader assumes that the Zookeeper will redirect it to actually collide, or, that he has already concealed its true trajectory from mankind and that the noncorpum Arupadhatu's example is a reality:

> Comet Aloysius could be on a collision course with the Grand Central Station, and unless your star guest here chose to let the instruments he controls tell your scientists, you wouldn't know a thing until you woke up one morning to find no sun and a winter of five hundred years! You wouldn't recognise the end of the world if it flew up your nose and died there! (423)

Creating a strong sense of fate around this ending, all four aspects integral to it – Bat, the Zookeeper, the comet and the apocalypse – are foreshadowed throughout the rest of the novel.

In 'Okinawa', Quasar comments, 'What a sick zoo the world has become, where angels are despised' (22); watching the military use of her technology, Mo observes, 'My, it's a sick zoo we've turned the world into' (324), and when she leaves Light Box, she 'empties zoos of my most virulent viruses on the disks I'd leave behind' (335). The Bat first appears in 'Tokyo' on a record-shop customer's T-shirt – 'A bat flying around a skyscraper, leaving a trail of stars' (35) – which, we discover in 'Underground', is the design of the poster advertising Bat's show; Saturo also hears a political campaign wagon screech past 'like a batmobile' (61). In 'Mongolia', sensitive to the spirit within her, 'Gunga's heart pounded like a boxed bat' (173), and

the bats from the myth take corporeal form when the spirit does: as he re-enters the baby's body, 'Outside, the bats dangle from the high places, fluttering up to the sky, and down to the ground, and up to the sky again, checking that all was well' (202). In 'Petersburg' after the heist, Margarita's sense of foreboding – 'For the fiftieth time I felt there was something wrong' (248) – is set against a backdrop of half-light in which 'bats flickered here and there' (248); by the time she finishes her cigarette, 'Even the bats had gone. What was wrong now?' (254). In this story, the Head of Security at The Hermitage also has a 'bat-faced brother-in-law' (249). In 'Clear Island', the hippy Red Kildare is inexplicably reminded of Mo when 'a dead bat fell out of the sky and landed at [his] feet' (329); John has a 'bat-cloak dressing gown' (338); Mo uses the image of 'Batman versus the Joker' (341) to describe the war; John explains to the suspicious visitor that he is blind '…as a bat. A lot blinder than a bat, actually. I'm unequipped with sonar' (346); and Mo is startled coming upon a 'fangy little dead bat with its face half-eaten away' (364).

The comet makes it journey through the novel from beginning to end. It first appears in 'Okinawa' where His Serendipity predicts its apocalyptic impact: 'I have seen the comet, far beyond the farthest orbit of the mundane mind. The New Earth is approaching. The judgement of the vermin is coming' (17). It reappears in 'Holy Mountain' where the Tea Shack Lady observes that 'A comet was in the north-east' (135) again bearing with it negative connotations: 'Is it the comet do you think? Could it be bathing the world in evil?' (140). In 'Mongolia' the comet serves as a harbinger of the noncorpum's arrival for the grandmother of the baby at the end of the story who was the little girl who witnessed the noncorpum's creation – 'It's about time! I saw the comet' (201). Margarita wonders if the light she sees in the sky is a comet in 'Petersburg' (230) and they also figure in her dreams (239). In 'London' we learn that Katy Forbes has 'a birthmark shaped like a comet' (305) and Marco uses the comet as an example of the insignificance of humans to the grand workings of the universe: 'A comet doesn't care if humans notice its millennial lap' (316).[x] Finally, in 'Night Train', anticipating the way in which the subject of both books are shortly to combine to end the world, Dwight Silverwind's bestselling *The Invisible Cyberhand* replaces *Earthbound Comet* in the top ten (400).

This cataclysmic effect of the comet is prefigured in apocalyptic images throughout the novel: the harbourmaster on Kumejima sees Quasar 'all hunched like it was the end of the world' (32); Neal wonders, amongst other things 'Would the

world be over by Christmas?' (105); Caspar feels like 'the end of the world is waiting in whose mountains, somewhere…' (164); Margarita brags that her political lover was so powerful 'He could have ended the world if he'd wanted to, virtually' (210); and the White Nights which figure the apocalypse predicted by His Serendipity arrive literally in Petersburg's long summer nights: 'The White Nights were here' (254). More of such references mount up in 'Clear Island' where the weather is so bad 'It looks like the end of the world out there' (351) and in the supposedly mad ravings of callers into Bat's show in 'Night Train': 'the end's coming' (383). The end of the world becomes a reality in 'Night Train' as WWIII looms and is only prevented by the Zookeeper's intervention in the weapons' systems of both sides. Little does mankind know that it has only avoided this disaster to encounter another as 'Comet Aloysius veer[s] in front of Orion' (416). Whilst the microscopic and macroscopic causes between the stories may indeed follow the rules of chaos theory, it seems that, in the world of *Ghostwritten* at least, events at the cosmic level follow a fateful predetermined, predictable and unalterable path.

III. Time

In its engagement with causality, *Ghostwritten* moves beyond the linear cause and effect of classical physics and embraces the new concepts of the science of complexity. At the same time, however, it also weaves into its macroscopic plot a mythic predeterminism. A similar movement from classical physics to complexity overlaid by myth and, in this instance, science fiction, can be found in the novel's engagement with time. The interactions between moving bodies in Newtonian physics are time-neutral, that is, classical dynamics makes no distinction between the past and the future and all events are theoretically reversible. Dynamical motion thus occurs in what Alexandre Koyré calls a paradoxically 'intemporal time' (Koyré cited in Prigogine 1980: 2). Since 'everything is given in classical physics' (Prigogine 1980: 3) it bears the 'conviction that the future is determined by the present, and therefore a careful study of the present permit[s] the unveiling of the future' (Prigogine 1980: 214) – from known initial conditions classical physics believes it can derive eventual effects. As Prigogine notes, although this founding vision of theoretical physics was at no time 'more than a theoretical possibility', this 'unlimited predictability was an

essential element of the scientific picture of the physical world. We may perhaps even call it the founding myth of classical science' (980: 214). In providing a scientific explanation that corresponds to lived experience, chaos theory has not only challenged the dominance of Newtonian physics scientifically, but also cast the founding myths of classical physics in a fictional light. According to Porush,

> by contrast with the recognizable sensibility of the world described by chaos, Newton's world – where reactions could be reversed and all interaction reduced to very simple laws – seems like a sort of weird SF space, a minimalist abstraction belonging to some imaginative experiment. (1991: 382)

Paradoxically, classical physics' commitment to predictability resonates more with mankind's superstitious and mythic beliefs than those popularly considered scientific or rationale. Another mythic element running through *Ghostwritten*, for example, is precisely this belief in predictability, with many characters foreseeing future events. His Serendipity believes in predictable, determinable time, translating his apocalyptic predictions into certainty: 'This is not a prophecy. This is inevitable, future reality' (Mitchell 1999: 9). The noncorpum is astonished by the sensitivity of the Tea Shack Lady who senses satellites observing her life, precisely the satellites the Zookeeper inhabits to keep a check on the world, but which are not yet in orbit:

> 'Extraordinary! How do you tune yourself into these things?'
> 'What do you mean?'
> 'It hasn't even been launched yet!'' (140-1)

Many other characters have flashes of foresight, predicting future events from current circumstances: Bodoo's brother senses he is going to die in 'Mongolia' (188); the Tea Shack Lady knows when things are going to happen; Margarita knows that this heist is doomed – 'Right then, it felt wrong' (221); Timothy Cavendish ignores 'warning bells' (294) regarding the publication of His Serendipity's book and Mo knows that today is the day the Texan comes to 'Clear Island' (368). In 'London', Marco insists that 'The future already exists. Prophets can see what is already there. Anyone can predict effects from a given cause. That's a definition of sentient life, from storing food to satellite weather forecasting' (311). (Unfortunately, Marco's last example

somewhat undermines his argument since weather systems are dissipative structures that precisely do not conform to linear causal analysis but to the statistical causality of chaos theory.)

One of the most important consequences of Prigogine's theories is the reintroduction of time to theoretical physics. The occurrence of dissipative structures 'greatly modifies the very meaning of space and time' (Prigogine 1980: 104) breaking the homogenous understanding of both to be found in Euclid and Galileo. Whereas in classical and quantum mechanics, the 'theoretical framework seems to indicate that in some sense the present already "contains" the past and the future' (Prigogine 1980: xvii) in the science of complexity this is not the case: 'The future is not included in the past. Even in physics, as in sociology, only various possible "scenarios" can be predicted' (Prigogine 1980: xvii). More complexly, Prigogine introduces into his equations a new operator time – this is different to the time that labelled trajectories in classical and quantum mechanics and is a consequence of the uncertainty relation. This new operator, time, contributes to the determination of macroscopic time 'which emerges as a kind of average over "individual times" of the ensemble' (1980: 210). In addition, time is reintroduced via the crucial idea of irreversibility integral to the second law of thermodynamics: 'It postulates the existence of a function [entropy] having quite specific properties such that in an isolated system it can only increase in time' (Prigogine 1980: 6). Reversibility, more popularly known as time travel, would involve the necessity of breaking the entropy barrier, something which, as yet, remains unachievable. The science of complexity thus reintroduces time into theoretical physics, providing scientific justification for our intuitive understanding that all living organisms have a sense of the direction of time.[xi] In doing so, for Prigogine and Stengers, time, or to be precise, science's rediscovery of it, is the key concept that brings science into line with the arts and humanities: 'The dichotomy between the "two cultures" is to a large extent due to a conflict between the atemporal view of classical science and the time-oriented view that prevails in a large part of the social sciences and humanities' (Prigogine and Stengers 1985: xxviii). The recognition of the importance of time by the science of complexity resolves this distinction.

Ghostwritten's time can be understood specifically in relation to its status as what Humberto Maturana and Francisco Varela call an autopoietic system – a living system as defined by its self-contained unity and the production of its own

components. In *Between Science and Literature* (2006), Ira Livingston reminds us of 'the apparent paradox of autopoiesis, that systems produce their own components' (88), drawing particular attention to the temporal paradox which this involves:

> Part of the *circularity* of an autopoetic systems is a kind of causal loop, which also appears as a kind of time loop…an autopoetic system is an eddy in linear time, or, to put it another way, autopoetic systems constitute *relational time*. The general banishment of relational time from science seems to have driven the time loop into exile as a staple science-fictional premise, though perhaps autopoiesis theory will allow this prodigal son to be rehabilitated in some fashion. In the meantime, this eddying flow is familiar as the operation of *meaning* in language: in the flow of speech and writing, words that come after alter the meaning of words that came before, making meaning a continual and more or less open-ended recontextualizing. (Livingston 2006: 88)

Livingston's description is exactly what we see at work in *Ghostwritten*. As noted above, *Ghostwritten* is circular in structure, the final chapter returning the reader to the opening. This does indeed cause a time loop in the reading of the novel whereby the reader ends the novel only to begin it again – if this is performed literally, the odd effect of this relational time is experienced as the reader begins to distinguish between retrospective and anticipatory connections between the stories, only to realise that in the time loop all connections are both retrospective *and* anticipatory. Just as this eddying flow is the operation of meaning in language, it is also the operation of meaning in the autopoietic text in which the stories that come "after" alter the stories that come "before" in an endless recontextualising process that lends *Ghostwritten* not only its meaning but also its uncanny vitality.

IV. Autopoiesis

In the preface to *Autopoiesis and Cognition: The Realization of the Living* (1980), the editors explains how the authors, Maturana and Varela, 'have undertaken to provide a systematic theoretical biology which attempts to define living systems *not* as they are objects of observation and description, nor even as interacting systems,

but as self-contained unities whose only reference is to themselves' (v). In the general introduction, Maturana explains that he and Varela understand 'living systems as systems defined as unities through the basic circularity of their production of their components' (xiv). Such systems have neither inputs nor outputs, and in relation to them 'the external world would only have a triggering role in the release of the internally-determined activity of the…system' (xv). Maturana coined the word autopoiesis to 'directly mean what takes place in the dynamics of the autonomy proper to living systems' (xvii) and, indicating an originary link between the theory of autopoietic systems and literature, he explains how he arrived at the word:

> one day, while talking with a friend…about an essay of his on Don Quixote de la Mancha, in which he analysed Don Quixote's dilemma of whether to follow the path of arms (*praxis*, action) or the path of letters (*poiesis*, creation, production), and his eventual choice of the path of *praxis* deferring any attempt at *poiesis*, I understood for the first time the power of the word 'poiesis' and invented the word that we needed: *autopoiesis*. (xvii)

Autopoiesis literally means self-creation, and although it here applies to the self-productive circular organisation that is the necessary and sufficient condition for the characterisation of living systems, it cannot shake off its etymological link with the creative production especially of a work of art.

Maturana and Varela define an autopoietic system in the following way:

> *An autopoietic machine is a machine organized (defined as a unity) as a network of processes of production (transformation and destruction) of components which:* (i) *through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and* (ii) *constitute it (the machine) as a concrete unity in the space in which they (the components) exist by specifying the topological domain of its realization as such a network.* (1980: 79)

Crucially, 'for a machine to be autopoietic, its defining relations of production must be continuously regenerated by the components which they produce' (79). In other words, and this is where the circularity of Maturana and Varela's language reflects the

circularity of autopoietic organisation, rather than producing outputs, autopoietic systems produce the components which then constitute them as such a system. Maturana and Varela's theory becomes particularly interesting in its consequences for the definition of what is living – living systems, such as human beings, are clearly autopoietic systems, since 'they transform matter into themselves in a manner such that the product of their operation is their own organization' (82) but Maturana and Varela also posit, conversely, that autopoiesis is the definition of a living system. Consequently, synthetic autopoietic systems ought necessarily to be considered living; Maturana and Varela's theory thus challenges our received opinions about the division between what is artificial and what is natural. According to their theory, not just plants and animals ought to be considered as living, but, as Stafford Beer observes in his preface to *Autopoiesis: The Organization of the Living* (1973), so should social institutions such as 'firms and industries, schools and universities, clinics and hospitals, professional bodies, departments of state, and whole countries.' (70); works of literature, in particular the one under discussion here, might also be added to this list.[xii] *Ghostwritten* can be understood as an autopoietic system in the sense that it constitutes 'a closed domain of relations specified only with respect to the organization that these relations constitute' (Maturana and Varela 1980: 88). The interconnections between the stories that constitute *Ghostwritten* both characterise and constitute it as a text; they define the space that is *Ghostwritten*, the one in which it is realised 'as a concrete system' (Maturana and Varela 1980: 88).

With regard to the origin of autopoietic systems, Maturana and Varela decide to accept 'the existence of living systems as existential proof of the factibility of the spontaneous generation of autopoietic systems' (95). That is, the fact that life exists is evidence that, at least at some point, the conditions conducive to the production of life have existed. Prigogine suspects that these conditions are analogous to the bifurcation points in his theory of dissipative structures at which far-from-equilibrium systems, such as autopoietic structures, undergo spontaneous self-organization:

> It seems that most biological mechanisms of action show that life involves far-from-equilibrium conditions beyond the stability of the threshold of the thermodynamic branch. It is therefore very tempting to suggest that the origin of life may be related to successive instabilities somewhat analogous to the

> successive bifurcations that have led to a state of matter of increasing coherence. (Prigogine 1980: 123)

Far from being heteropoietic systems – products of human design – works of literature are autopoietic systems, dissipative structures that evolve from the far-from equilibrium conditions of the mind of the author, structures that self-organize out of chaos.[xiii] In this sense, works of literature are not merely as autonomous as a grown child making his or her way in the world, but as autonomous as the unity of an autopoietic living system.[xiv]

Ghostwritten is both a simple unity distinguished from its background by the basic cognitive operation performed by an observer, the operation of distinction, and a composite unity which 'exists in the space defined by its components' (Maturana and Varela 1980: xix).[xv] These components, the individual stories, are also autopoietic systems which are structurally coupled with each other:

> Whenever the conduct of two or more unities is such that there is a domain in which one is a function of the conduct of the others, it is said that they are coupled in that domain. Coupling arises as a result of the mutual modifications that interacting unities undergo in the course of their interactions without loss of identity. (Maturana and Varela 1980: 107)

This coupling 'leads also to the generation of a new unity that may exist in a different domain from the domain in which the component-coupled unities retain their identity' (Maturana and Varela 1980: 107). Thus the stories that constitute *Ghostwritten* as a composite entity exist within the space of the text, whereas the unity that is *Ghostwritten* exists in the cognitive domain of the reader.[xvi] As the reader reads *Ghostwritten*, the stories interact with each other in such a way that they grow and adapt whilst always preserving their identity and without losing their independence, without loss of autopoiesis. As Porush explains, 'a system can alter itself as it grows and grows. While individual phenomena remain relatively coherent (my son remains recognizably himself, even though he changes minute to minute, year to year), they are also dynamic, grow in sudden spurts, alter the environment which alters them' (1991: 369). In this sense, *Ghostwritten* and its stories are always in process – this accounts for the uncanny experience of reading, re-reading and re-re-reading the text.

Each reading the stories remain the same yet appear different as more and more interconnections between them come to light. As a consequence, the reader's idea of the composite unity of the novel as a whole both remains recognisably the same and yet also adapts and changes. This accounts for A.S. Byatt's succinct observation that 'it's even better the second time' (Mitchell 1999: blurb); one might easily add, third, fourth and more.[xvii]

From a critical perspective, the risk inherent in this structure is that of treating the individual stories as allopoietic not autopoietic systems.[xviii] Critical commentary, including this one, thus tends to pay attention to them only 'in relation to their participation in the constitution of the unity (whole) that they integrate' (Maturana and Varela 1980: xix). As Maturana and Varela explain:

> We can describe physical autopoietic machines, and also manipulate them, as parts of a larger system that defines the independent events which perturb them. Thus…we can view these perturbing independent events as inputs, and the changes of the machine that compensate these perturbations as outputs. To do this, however, amounts to treating an autopoietic machine as an allopoietic one, and to recognize that if the independent perturbing events are regular in their nature and occurrence, an autopoietic machine can in fact, be integrated into a larger system as a component allopoietic machine, without any alteration in its autopoietic organization. (1980: 82)

This explains the nature of the novel's stories and the way in which they relate to each other and the novel as a whole: the stories are both independent autonomous autopoietic systems *and* allopoietic systems when treated recursively as part of the autopoietic novelistic whole.[xix] The regular perturbing event that activates this structure is the act of reading. In 'Why Literature Matters' (1996), Wolfgang Iser claims that since the literary text has to be 'processed by the reader' (17) its autonomy is artificial and incomplete. In making such an argument Iser fails to account for the new role for the reader, or observer, provided for in the science of complexity. Here, the activity of the reader/observer does not challenge the autonomy of the autopoietic system – his or her observations remain in the metadomain of description – at the same time as his or her activity can effect change in the system. In Prigogine's language, 'it seems that environmental fluctuations can both *affect bifurcation* and –

more spectacularly – *generate new nonequilibrium transitions* not predicted by the phenomenological laws of evolution' (1980: 147). The activity of the reader can generate transitions, provoke the adaptation of the system, which, if it is an autopoietic system, adapts whilst retaining its identity as such. As Prigogine and Stengers explain, 'to use somewhat anthropomorphic language: in equilibrium matter is "blind," but in far-from-equilibrium conditions it begins to be able to perceive, to "take into account," in its way of functioning, differences in the external world…' (1985: 14). In autopoietic systems – in this instance, recursively, *Ghostwritten*, the stories that constitute it, the language that constitutes them[xx] – matter wakes up and responds.[xxi]

V. Conclusion

In a review of *Ghostwritten* in the *New York Magazine*, Daniel Mendelsohn compares the novel with one of the giants of the literary canon: Tolstoy's *War and Peace*. Mendelsohn makes this comparison in order to criticise Mitchell's novel for failing to employ the same narrative methodology as Tolstoy's. According to Mendelsohn, *War and Peace*'s greatness derives from the way in which its reflections on the larger themes of desire, time and history arise out of the minute focus on the personal passions of its characters. *Ghostwritten* fails to achieve greatness, the logic of the argument implies, since it does not replicate this pattern. In direct conflict with Mendelsohn's assessment, however, this paper has demonstrated that *Ghostwritten*'s greatness lies precisely in not taking this approach – whereas Tolstoy's nineteenth-century novel understandably mirrors the scientific methodology of its time which prioritised the microscopic over the macroscopic, *Ghostwritten* replicates chaos theory by focusing on the macroscopic. In doing so, it responds to the contemporary world in all its seething complexity and provides an understanding of the nature of causality, time and literature in that world that *War and Peace* cannot provide. The text gently suggests this itself, when Caspar asks Sherry about the novel she is reading, Tolstoy's *War and Peace*:

'What's it about?'

'Why things happen the way they do.'

'And why do things happen the way they do?'

'I don't know, yet. It's *very* long.' (156)

Traditional linear narratives are now being replaced by complex systems that more accurately represent our experience of the contemporary world – of these, *Ghostwritten* is one of the greatest examples. Whilst other reviewers have also criticised *Ghostwritten* for its failure to resemble nineteenth and twentieth century literary novels, two at least have recognised that such criteria might no longer apply: *Ghostwritten*, Nicholas Blincoe concludes, 'fails insofar as it resembles a 20th-century literary novel, but succeeds stunningly where it imagines a literature for the 21st century' (Blincoe 1999); Sherri Hallgren observes that 'perhaps the scope of the novel is too vast, its relation to its characters simultaneously too intimate yet too impersonal, to make for the kind of coherent sensibility we expect in a novel. But it is a convincing, if disturbing, picture of the complex world as we near the 21st century' (Hallgren 2000). In conclusion, *Ghostwritten* forces us to revise our literary criteria, not least those we use to define what "great" literature might be.

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Notes

[i] Reviewers tend to be divided between those who consider the interconnecting structure to be a weakness of the novel, and those who consider it to be its strength. Sherri Hallgren thinks that the connections between the stories are never significant within them (Hallgren 2000) whereas Jason Picone argues that 'the connections that the reader draws among all these voices ultimately form the novel's core' (2001: 193). *The Complete Review* agrees with Picone, going so far as to say that 'the sum is far greater than the parts (none of the episodes are good enough to be considered successful short stories)…Mitchell neatly makes the transition from one section to the next, often with what appear to be inconsequential encounters and occurrences (or occurrences that are consequential in entirely unexpected ways). These transitions are, in fact, the most successful part of the novel.'

[ii] Amongst those to which *Ghostwritten* has been compared are: Richard Linklater's film *Slacker* (1991); Arthur Schnitzler's play *La Ronde*, written in the late 1890s; the contemporary novel *House of Leaves* (2000) by Mark Z Danielewski (all in Miller 2000); as well as Alex Garland's *The Tesseract* (1998) and Simon Lewis's *Go* (1998); and modernist episodic novels including James Joyce's *The Dubliners* (1914) and Samuel Beckett's *More Pricks than Kicks* (1934) (all in Blincoe 1999). None of these comparisons is developed in any detail and some, even at a cursory glance, are inappropriate – *Slacker*'s structure of moving from one character to another, for instance, is monotonously linear with none of the complex interweaving found in *Ghostwritten*; a more interesting filmic comparison, although also less complex than

Mitchell's novel, would be Gurinder Chadha's *What's Cooking?* (2000). Garland's *The Tesseract* provides perhaps the most interesting comparison given: its shared interest in causality – this manifests itself in such comments as 'The moon orbits the earth. High tides and low tides come and go, the cause being gravity but the reason being nothing' (Garland 1998: 26) and in Alfredo's reasons for undertaking PhD research into Manila's street children, 'And the answer, Alfredo knew, was going to be hard to express. If at all, it was going to be found in the statistics of cosmic distances, as bound to complexity as the light from that evening's sunset' (247); its subtle phrasal repetitions – compare the opening of 'Black Dog', 'There was no bright colour in the room' (3) with the opening of 'Black Dog is Coming', 'The view outside the kitchen window was full of colour' (109); the reiteration of characters on scales of more or less significance depending upon which story they are in; and the name of a character, Uncle Rey, which recalls the title of Thornton Wilder's *The Bridge of San Luis Rey* (1927) from which the epigraph to *Ghostwritten* is taken. *The Tesseract* also indicates its link with science in its title – a tesseract is 'a four-dimensional object – a hypercube – unravelled' (Garland 1998: 308) – and it functions in the novel as a metaphor for the way in which we only have access to an unravelled version of events, never to 'the thing itself' (308). This accounts for the narrative structure of *The Tesseract* which tells a certain set of events from the perspective of the different characters involved in them, a narrative technique that differs from that of *Ghostwritten* which is more ambitious in its temporal and geographical range, evoking the global interconnection of vastly differing lives.

[iii] In particular, the repetition of a similar plot across the three stories of *Palimpsest* has encouraged critics to identify this plot and its protagonists with H.D. and the events of her life, particularly her experiences during World War I. For a more detailed discussion of the second two stories of *Palimpsest* see 'Queering the Palimpsest: H.D.' in Dillon (2007), pp. 102-26.

[iv] In the only existing published academic article on *Ghostwritten* at the time of writing – '"On the Fringe of Becoming" - David Mitchell's G*hostwritten*' (2004) – Phillip Griffiths employs the metaphor of the palimpsest in his analysis of the structure of the novel: 'Earlier, the notion of "identity in process" was described as being situated at the crossroads between the syntagma of sequence and the paradigm of palimpsest. The same holds true for the chapters themselves. On the one hand they

are part of the sequence that make up the novel in its entirety, on the other hand they are caught in a peculiarly dynamic process of embedding, one chapter slipping under the other only to have that chapter slip under the next in what could be called *Ghostwritten*'s sequential palimpsest' (94). Griffiths' essay attempts to mirror the complexity of *Ghostwritten* by bringing together a range of ideas from contemporary literary theory to account for it, including 'Jacques Derrida's concept of *difference* and the trace structure of the sign, Mikhail Bakhtin's notion of dialogic polyphony, Jean-Francois Lyotard's deconstruction of the grand narratives of teleological history and Manfred Pfister's differentiation between inter- and intratext' (79). Whilst the ambition of this approach is not quite realised and whilst I would contest much of Griffiths' argument – not least his understanding of the relationship between literature and theory and his situation of *Ghostwritten* as a postmodern novel – it is an important essay in insisting on the necessity to pay academic and scholarly attention to Mitchell's work.

[v] All further reference to *Ghostwritten* (1999) will be given as page numbers in parentheses in the text.

[vi] While reviews of the novel all comment on the interconnections, and even enumerate a few of them, no review has provided a detailed account of these connections that demonstrates evidentially the intricate structure of the novel. This is no doubt due to the spatial limitations of the review format and the daunting number of connections. Without in any way being exhaustive, I will detail some of those connections here in order to rectify this omission in current writing about the novel.

[vii] Connections between *Ghostwritten* and *Cloud Atlas* include repeated characters, such as Denholme and Timothy Cavendish, Hester Swain and Luisa Rey, and repeated motifs, such as that of the comet. Saturo's reflections about the possibility of meeting his estranged wealthy father in *Ghostwritten* also anticipate the plot of Mitchell's second novel, *number9dream* (2001).

[viii] This type of causality is of course more popularly known, via James Gleick's account of Edward Lorenz's research, as the butterfly effect; see Gleick (1987: 9-31).

[ix] Porush notes that 'what makes this narrative program so interesting is that such a view of time and causality is the very stuff of the traditional novel, of the narrative, of the human point of view, of macroscopic realism. Yet by virtue of the new paradigmatic of Chaos Theory, this appreciation for human-bound (and one might

say, subject bound) discourse has now insinuated itself into the belly of science's grand *Weltanschauung*. Physics has caught up with Fielding, Dickens, Austen, Trollope, Flaubert, Tolstoy, and every other novelist for whom small accidents send the hearts of mortals and their fates wheeling out of their appointed Newtonian orbits into grand twists of fate and destiny' (1991: 381). Porush concludes that 'without a recognition of the powerful role the Butterfly Effect plays in human destiny, virtually every great novelist and dramatist, including Shakespeare, would have been out of business' (1991: 382).

[x] Katy's comet-shaped birthmark links her with a number of the characters in *Cloud Atlas* who also bear this mark.

[xi] This sense of time is one of Niels Bohr's *primitive concepts* that are 'not known a priori, but every description must be shown to be compatible with their existence' (Prigogine 1980: xv).

[xii] Wolfgang Iser's assertion that literary texts are not autopoietic systems since they are not living fails to account for this way in which Maturana and Varela's theories cause us to redefine our understanding of what is living (Iser 1996: 17).

[xiii] As Porush notes, 'if we wander down the pathway pointed to by Prigogine's theories we might define mind as one of the most fertile dissipative structures, itself a product of the dissipative structuration of biological evolution and in turn a great progenitor of other dissipative structures, like technology and literature which extend its power and promulgate information' (1991: 384, n.1). The question of the origin of life also provides the link between Maturana and Varela's theory of autopoietic systems and Prigogine's theories, between, as Porush puts it, 'Prigogine's theories of self-organization out of chaos and the cybernetic project to grow artificial-intelligence devices' (379), an intimate connection upon which Porush comments in passing but which he does not elucidate in detail.

[xiv] David Mitchell uses the analogy of a child to describe his relation to his work: 'Once you've written a book and had it published, it's like your offspring, and you remain interested in how it makes its way in the world. At the same time, you do feel an odd detachment in that it's beyond your control. I suppose it's like having an eighteen year-old who's starting to make his or her own life' (Mitchell 2002 with Hogan).

[xv] 'The fundamental cognitive operation that an observer performs is the operation of distinction' (Maturana and Varela 1980: xxii).

[xvi] As Maturana explains, by the operation of distinction, the observer distinguishes entity and background, although the odd consequence of this is that the operation of distinction severs the unity from this background. Operations of distinction produce new unities: 'Thus, although a distinction performed by an observer is a cognitive distinction and, strictly, the unity thus specified exits in his cognitive domain as a description, the observer in his discourse specifies a metadomain of descriptions from the perspective of which he establishes a reference that allows him to speak as if a unity, simple or composite, existed as a separate entity that he can characterize by denoting or connoting the operations that must be performed to distinguish it' (Maturana and Varela 1980: xxii). In other words, a cognitive act produces a phenomenal reality.

[xvii] In helpful imagery, Ira Livingston encourages us to think of what he renames 'autopoetic systems' as 'all edges, interfaces' (2006: 83) since 'an edge is an ongoing negotiation rather than a structure' (83). As in Derrida's refiguration of the metaphoric relation via Heidegger (see Dillon 2007: 48-52), for Livingston the stories would not preexist and then interact; rather, they are the product of interaction in the first place.

[xviii] For an enumeration of the differences between autopoietic and allopoietic machines see (Maturana and Varela 1980: 80-81). In summary, an allopoietic system is not autonomous, does not have individuality and is not a unity, since its 'boundaries are defined by the observer, who by specifying its input and output surfaces, specifies what pertains to it in its operations' (81).

[xix] See Wolfgang Iser (1996: 17-18) for an application of this structure to a description of culture. Iser's ideas in section II 'Perturbing Noise' of 'Why Literature Matters' are drawn directly from William Paulson's *The Noise of Culture* (1988). They are applied to *Ghostwritten* by Griffiths who suggests that 'the quasi-autonomous genre nutshell that is a *Ghostwritten* chapter is forced to jostle for position with the chapter presently activated by the reader's imagination and thus becomes an allomonous system dependant not only on the activated chapter itself but also on the reader's memory (a process which is repeated as the reader moves along the sequence of chapters,

autonomous systems turning into allonomous ones as the reading process progresses)' (2004: 95).

[xx] Livingston argues that language is also an autopoietic system since it produces its own components (2006: 79).

[xxi] Prigogine and Stengers explain that 'At equilibrium molecules behave as essentially independent entities; they ignore one another. We would like to call them "hypnons," "sleepwalkers." Though each of them may be as complex as we like, they ignore one another. However, nonequilibirum wakes them up and introduces a coherence quite foreign to equilibrium' (1985: 180-1).